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## **Growth in Internet connection and use in British secondary schools 1997-9: current practice in and implications for teaching and learning in design and technology**

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# Growth in Internet connection and use in British secondary schools 1997-9: current practice in and implications for teaching and learning in design and technology

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## Abstract

*This paper presents the current data from a continuing longitudinal study of Internet connection and use in secondary schools in Great Britain. Using 1997 data as a baseline, changes in Internet connection and use since the announcement of the NGfL and NOF funding are tracked. Data includes:*

- *the types and numbers of computers, networks and computer suites*
- *the types and numbers of Internet connections*
- *methods of ensuring that pupils do not have access to unsuitable material*
- *the amount and type of use which is being made of Internet connections*
- *the distribution of Internet computers across subjects*
- *the pattern of use of the Internet within subjects*
- *the use of the Internet within D&T teaching*

*The present position is summarised and some future considerations are discussed.*

Keywords: ICT, Internet, secondary, D&T, policy, WWW

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## Introduction

When this survey work was first conceived, in late 1996, the Internet was a relatively new technology, which seemed likely to find a useful niche in schools. Substantial government policy initiatives in schools followed by a huge increase in public awareness and use of the Internet have transformed the context within which educational use of the Internet is situated. The 1997 survey results thus effectively form a benchmark – a period in which Internet connection and use was a matter of individual choice for schools and in which no funding assistance was available to them. Some significant pilot studies were in progress (DTI, 1997; DfEE, 1998a) and in 1997 the government produced proposals for the 'National Grid for Learning', aimed at connecting all UK schools to the Internet and at ensuring that there was significant high-quality educational content to enable schools to make good use of the Internet in teaching and learning (DfEE, 1997a). This was followed

by a programme to train all serving and training teachers to make effective use of all ICTs, including the Internet, in the classroom (NOF, 2000; DfEE, 1998b).

Subsequent rounds of data collection have covered the period in which the first part of this policy was being implemented and future rounds will follow the second and any subsequent parts of the policy to their conclusion. The detailed results of the 1997 survey were reported in Jervis and Steeg (1998a) and the implications for D&T summarised in Jervis and Steeg (1998b). The present paper reports the results of the 1998 and 1999 data collection rounds and compares them with the 1997 base data. We consider the current position, likely future development and its implications for teaching and learning in design and technology.

## Methodology

In each year, a postal survey was carried out of 1000 randomly selected secondary schools

	1997	1998	1999
Number of schools responding	116	175	159
% return	11.6%	17.5%	15.9%
Total number of pupils	94345	140475	153374
Largest school	1800	1710	2000
Smallest School	26	60	211
Median	883	800	950

Figure 1 Summary of responses

in Great Britain. (A similar survey was carried out in primary schools, which is outside the scope of this paper.) Response rates were between 11% and 18%, yielding data from which statistically significant findings could be extracted. The questions covered general information about the school, numbers of computers and the amount of use made of them, types and numbers of Internet connections, restriction of access and filtering of unsuitable material and the amount of use made of the Internet connections by various age groups in particular subject areas. There was also scope for respondents to add free-form comments on matters of interest or concern to them. Questions covering general provision of ICT equipment allowed comparison with the biennial (now annual) statistics collected by the DfEE (1997a, 1998c, 1999a) and gave some indication of whether

the sample was unbiased; there was a possibility that the best equipped and most enthusiastic schools would be more likely to respond and thus produce a skewed sample.

**The Results 1997-99**

*ICT Background*

The responses overall show an increase in both quantity and quality of ICT equipment available in schools and in the number of connected schools. This has not yet translated into extensive use of the Internet and we offer some possible reasons in our conclusion.

The responses received from schools in are summarised in Figure 1. Overall pupil:computer ratios improved slightly from 8.8:1 in 1997 to 8.1:1 in 1999, but changes in machine type showed an interesting pattern. (See Figure 2)

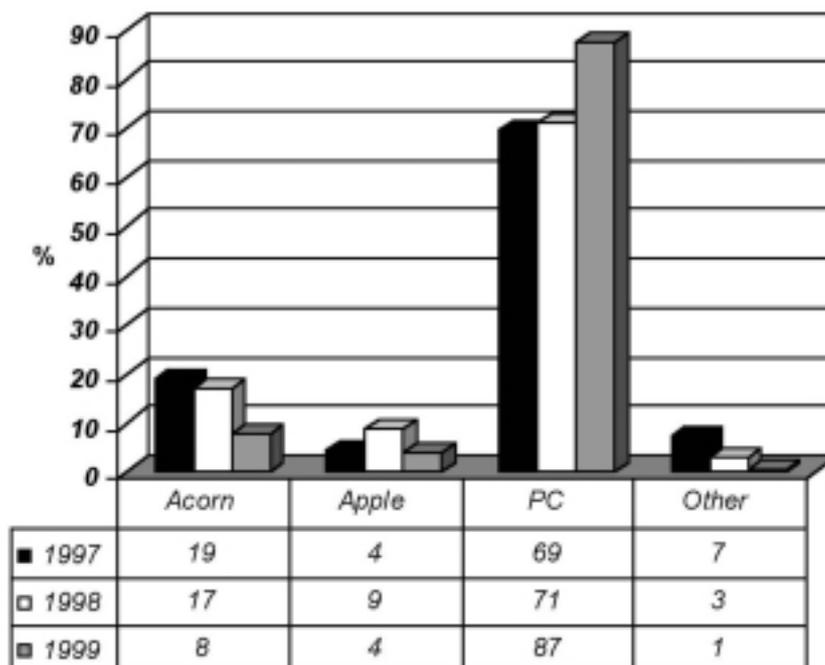


Figure 2 Computers by type

	1997	1998	1999
Networks (all types) per school	2.1	2.1	1.9
Computers per network	28.7	28.7	47.9
Suites per school	3.4	3.4	3.9

Figure 3 Networks and computer suites

It would appear that whilst schools are making modest increases to their ICT capability, they are taking advantage of funding to modernise their provision, retiring older equipment, particularly early Acorn and BBC machines. These figures agree well with the DfEE statistics for the corresponding years and suggest that the sample was genuinely representative of all secondary schools.

When schools had only one Internet computer connected via a modem, availability of Internet connection across a network was not an issue, but with a move to higher bandwidth connections, possession of networked computers is clearly important in distributing access. (See Figure 3)

Whilst numbers of computer suites and networks are approximately constant, there has been a two-thirds increase in network size between 1997 and 1999. With more and larger networks comes an increasing management overhead and there was a corresponding increase in the numbers of schools employing formal ICT technician support, from 64% in 1997 to 87% in 1999. The authors have expressed the view that the highly structured nature of the school day is an obstacle to increased Internet use and that a significant prerequisite for increased use is pupils' ability to have access to computers outside normal school hours. In previous work (Jervis and

Steeg 1998b) an arbitrary pupil:computer ratio of 20:1 was selected as representing a satisfactory level of out-of-hours provision. Figure 4 shows the availability of computers outside hours in the responding schools.

There has been a noteworthy change for the better in the availability of useful numbers of computers at lunch time and a possible improvement in after school provision.

### Internet Connections

The authors have predicted that schools that establish Internet connections later will leapfrog the 'experimental' phase of single PSTN connections and move directly to the medium bandwidth connections afforded by ISDN connections (Jervis and Steeg 1999). Figure 5 gives an overview of the types of connections schools have and of connection plans for schools that have no connection.

The overwhelming majority of schools have Internet connections and if plans translate into reality, all secondary schools will have an Internet connection by summer 2000, two years in advance of government targets (DfEE, 1997a). Most schools have ISDN connections, probably as a result of NGfL funding and the British Telecom flat-rate connection offer to schools (OfTEL, 1997). The increase in schools with significant numbers of connected computers is particularly striking.

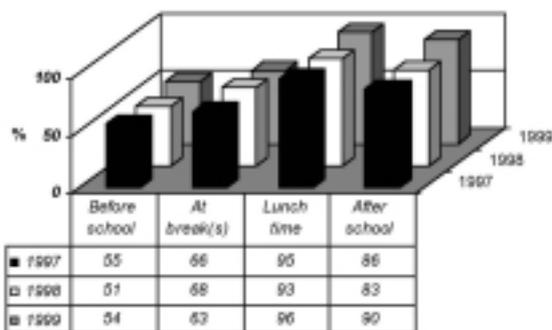


Figure 4a Availability of computers outside hours (1) (any number)

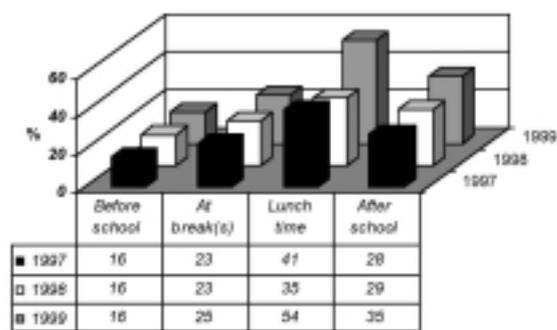


Figure 4b Availability of computers outside hours (2) (at ratio of 20:1 or better)

	1997	1998	1999
<b>Connections overview</b>	<b>% all schools</b>		
No connection	17	14	2
Connection	83	86	98
<b>Type of connection</b>	<b>% all schools</b>		
PSTN	84	66	41
ISDN	20	32	76
Leased line	2	2	6
Other	n/a	2	1
<b>Numbers of connected computers</b>	<b>% all schools</b>		
1 or more	78	85	97
1 per 20 pupils or better	9	19	47
<b>Connection plans</b>	<b>% unconnected schools</b>		
Next term	35	50	67
Next year	30	46	33
No plans	35	4	0

Figure 5 Overview of schools's conections to the Internet

There are real and justified fears about pupils having access to unsuitable material via unregulated Internet connections and so schools were asked about means of regulating access to the Internet and about means of

protecting Internet users from unsuitable material. The responses are summarised in Figures 6 and 7.

In secondary schools, it can be argued that

	1997	1998	1999
	<b>% connected schools</b>		
restricted hours	33	29	56
password protection	58	65	53
club membership	4	9	6
staff supervision	77	74	64
competence test	1	4	2
previously downloaded sites only	2	5	6
previously vetted sites only	0	4	18
signed agreement	9	24	59
by year group	6	7	9
access on particular machines only	51	45	31
max. hours per week per pupil	4	3	0
max hours/cost for connection	5	5	3
computer(s) in staff-only area	2	17	17
other restriction	3	0	0
no method	27	19	3

Figure 6 Means of regulating Internet access

	1997	1998	1999
	% connected schools		
screens in public view	55	64	69
pupils sign access agreement	10	24	63
published access policy	17	31	58
published policy shared with parents	10	17	54
vetting access logs	13	21	37
filtering software	19	24	50
filtered provider	45	41	74
preview of sites	14	7	14
using 'ratings aware' browser	7	12	11
staff supervision	72	79	71
access restricted to particular machines	48	49	36
other restriction	2	0	1
no methods	28	20	4

Figure 7 Protection from unsuitable material

pupils are able to comprehend the significance of signing formal agreements on access and these are an increasingly popular means of promoting compliance. So also is the use of a filtered ISP, though a number of respondents reported difficulties with 'mechanical' means of filtering, ranging from sites blocked for no obvious reason (the World Wildlife Fund was an example specifically mentioned in one response) to filtering software causing unexplained and apparently incurable system 'crashes'.

Schools that detected problems with unsuitable material rose from 25% in 1997 to 47% in 1999, though all instances were described as 'minor' and as having been satisfactorily dealt with. This percentage may be a significant under-reporting as it was often the schools with the most comprehensive systems in place that reported the problems, leading to the suspicion that problems are going undetected in some other schools.

Recent government advice states that schools "...must have systems and stated policies in place to ensure that children use the Internet safely..." (DfEE 1999b; see also BECTa, 1999) and so the large increase in schools adopting such policies is to be expected. However schools are certainly not blasé about the

potential problems and those reporting no difficulties usually showed great fatalism in phrasing their response as 'Not yet' rather than 'No'. A general issue for monitoring is that by no means all unsuitable materials originate with the school's own connection; a significant minority reported that unsuitable materials were being brought in from home and circulated on the school's intranet.

The move to broader bandwidth, 'always on', Internet connections increases the exposure of school computers and networks to viruses, hacking, cracking and DDoS (Distributed Denial of Service) attacks. Worryingly, even in 1999, only 68% of responding connected schools had 'Internet aware' virus checking with 23% unsure and 10% saying they did not.

**Internet Use**

The figures reported on Internet use must be treated with a degree of caution for reasons outlined below. The survey asked about use in two different ways because:

- we wanted to know the kinds of things that both staff and pupils were using the internet connection for;
- we were interested in how this use was distributed across subjects.

A useful result of this approach has been to

provide a means of comparing the levels of use reported in each way.

The question about uses of the Internet indicated significant increases in Internet use for both staff and pupils from 1998 to 1999. The most common uses of the Internet are shown in Figures 8-11. Note that these usage levels are expressed *per thousand* and that levels of use below 2 per thousand staff and 5 per thousand pupils in both years are omitted.

The data shown in these figures are likely to

under report Internet use since it was not always entirely clear whether null responses indicated no use or an inability of the respondent to provide any data. Despite this we are confident that the data accurately reflect both trends and patterns in use. Actual levels of use are likely to be rather higher than indicated. Bearing the above in mind, overall levels of use are still very low, with the most popular activities indicated only reaching levels of 150 staff per thousand and 50 pupils per thousand using the Internet at least once a term. Individual research and personal e-

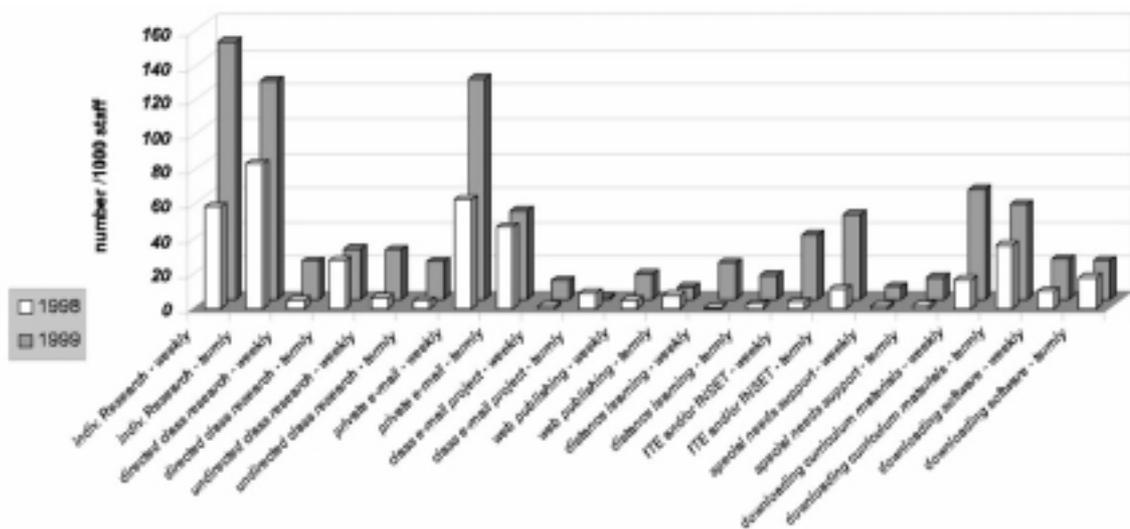


Figure 8 Internet use by secondary staff

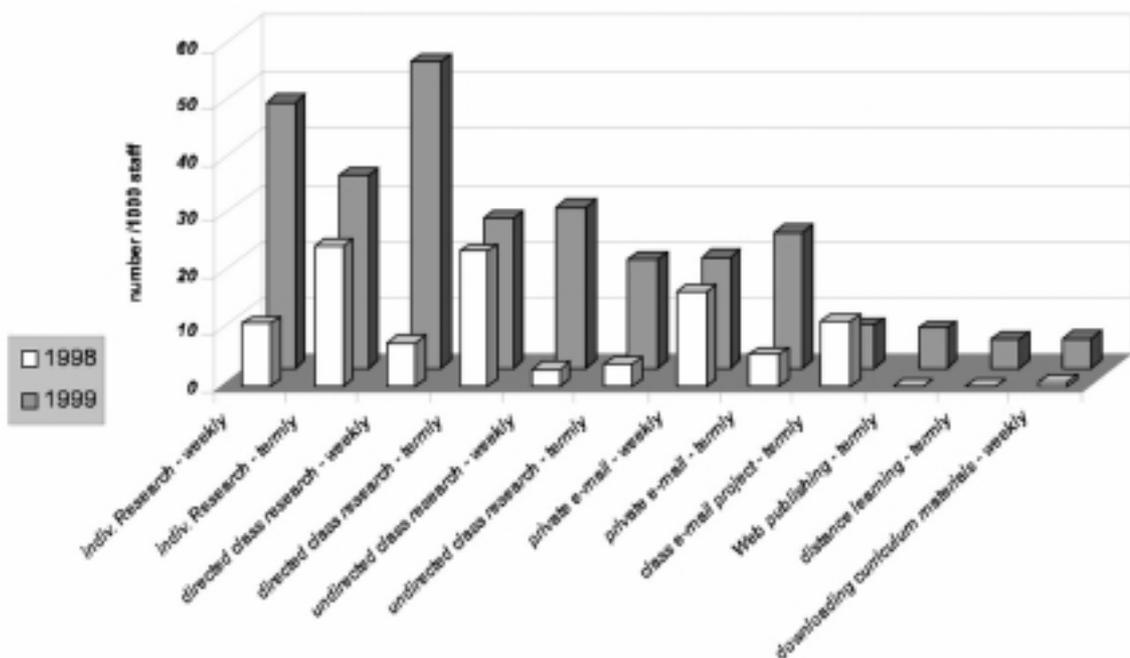


Figure 9 Internet use by KS3 pupils

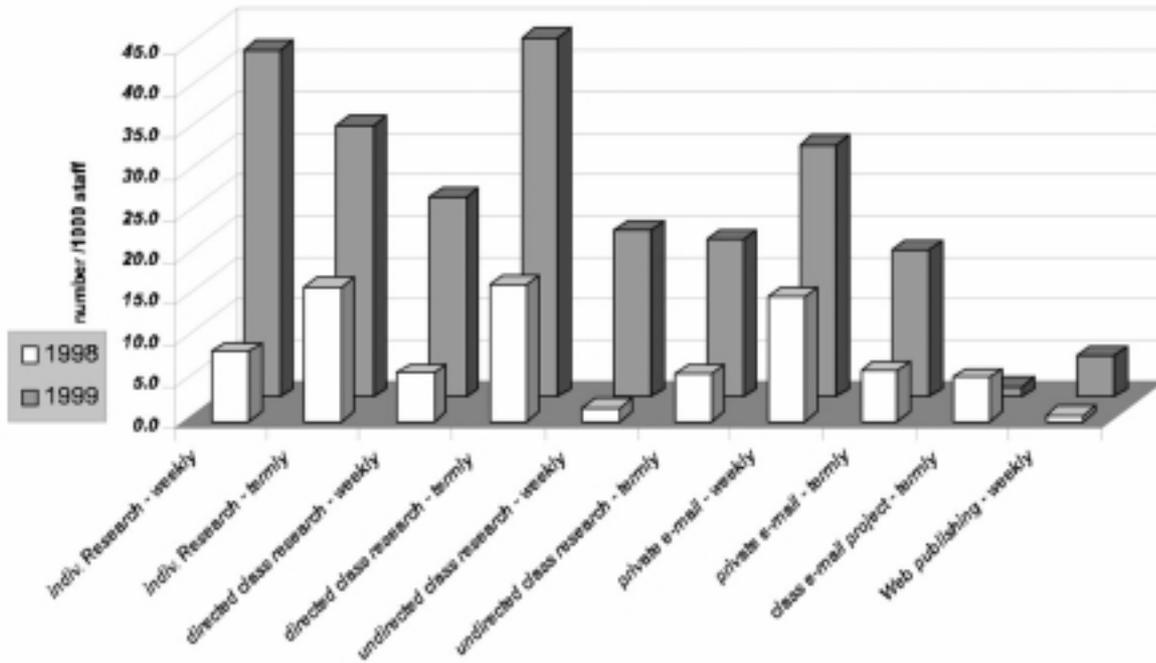


Figure 10 Internet use by KS4 pupils

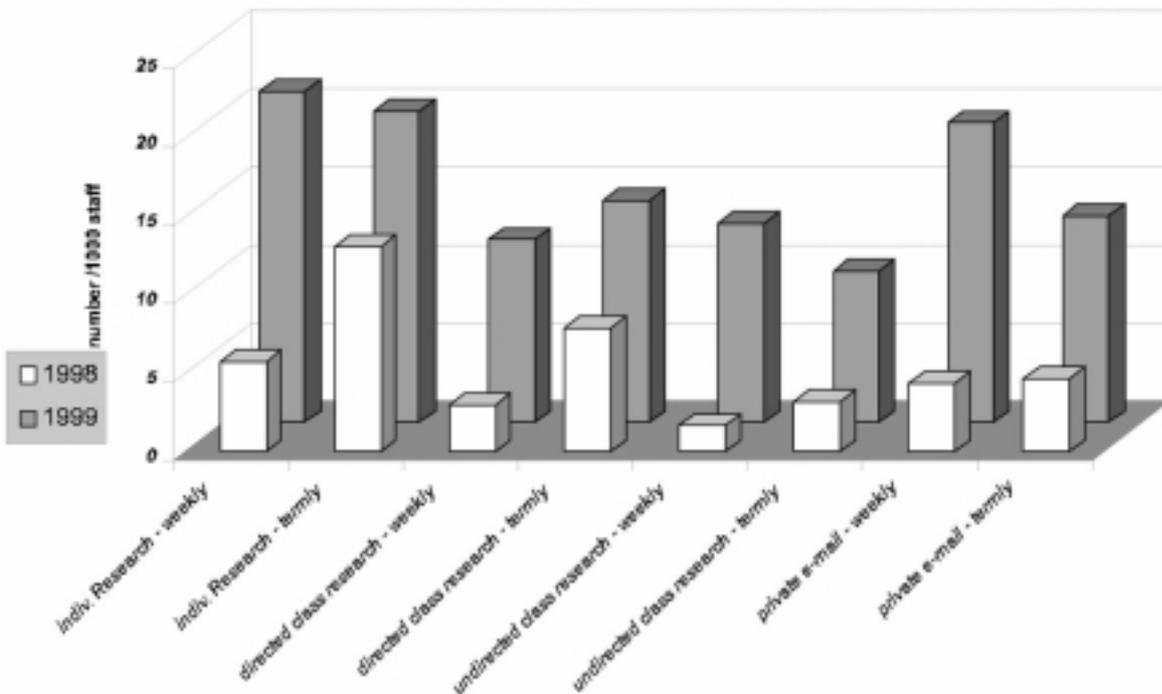


Figure 11 Internet use by post-16 pupils

mail are the most popular activities for both staff and pupils. We believe that these two form the 'must haves' of Internet use and that the skills and enthusiasms generated by these activities will transfer more slowly to other areas. This is particularly so for technologically inexperienced staff and these activities should be seen as confidence building which will allow

staff to go on and explore more and better uses of ICT, rather than a misuse of facilities provided for pupil use.

Questions about subject use of the Internet provide a different perspective on these data. Figure 12 shows the availability of Internet connections in subject areas.

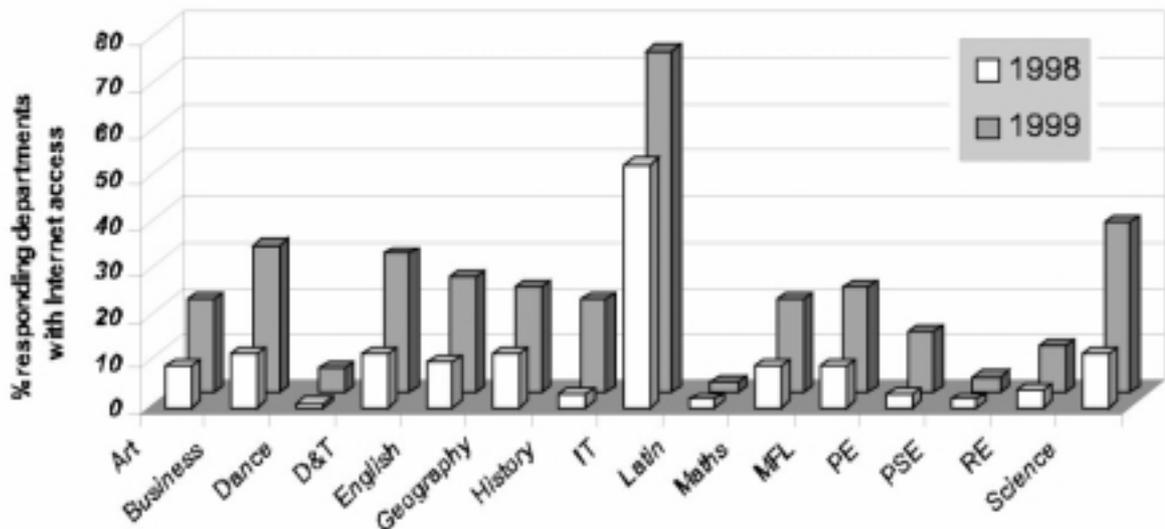


Figure 12 Availability of Internet computers in subject areas

Connection to departments grew considerably between 1998 and 1999, through from such a low base that connection levels remain low for all subjects apart from I(C)T. D&T is in a relatively strong position compared to most other subjects with 30% of departments having at least one Internet computer. Within departments the pattern of staff use was generally that just one or two teachers were the users. Figure 13 shows both the kinds and levels of use by teachers within departments.

that those staff making use of the Internet are, unsurprisingly, substantially concentrated in just a few subject departments. Scrutiny of Figures 12 and 13 suggests that possession of departmental Internet computers does not translate cleanly into levels of departmental Internet use; there are departments with fewer Internet computers than D&T who are making more use of the Internet.

Figure 14 shows in more detail the levels and types of Internet use in D&T departments.

The overall levels of use reported here are rather higher than (though comparable to) those in figure 8, which is consistent with our comments on underreporting above. It is clear

The growth in numbers of Internet computers available has not, quite, been matched by the growth in their use to support D&T teaching.

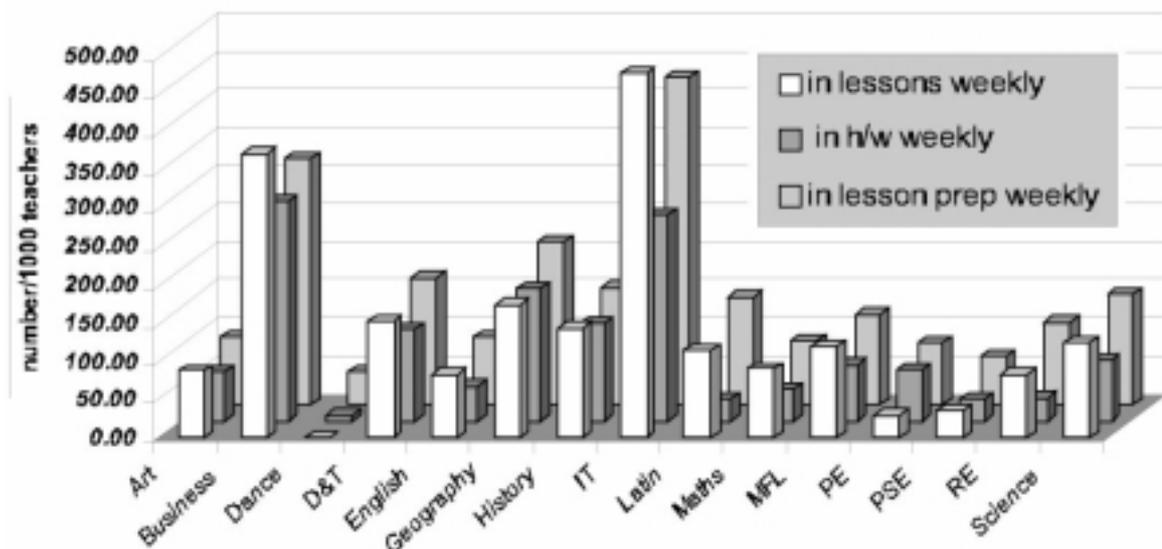


Figure 13 Use of the Internet by subject teachers in 1999

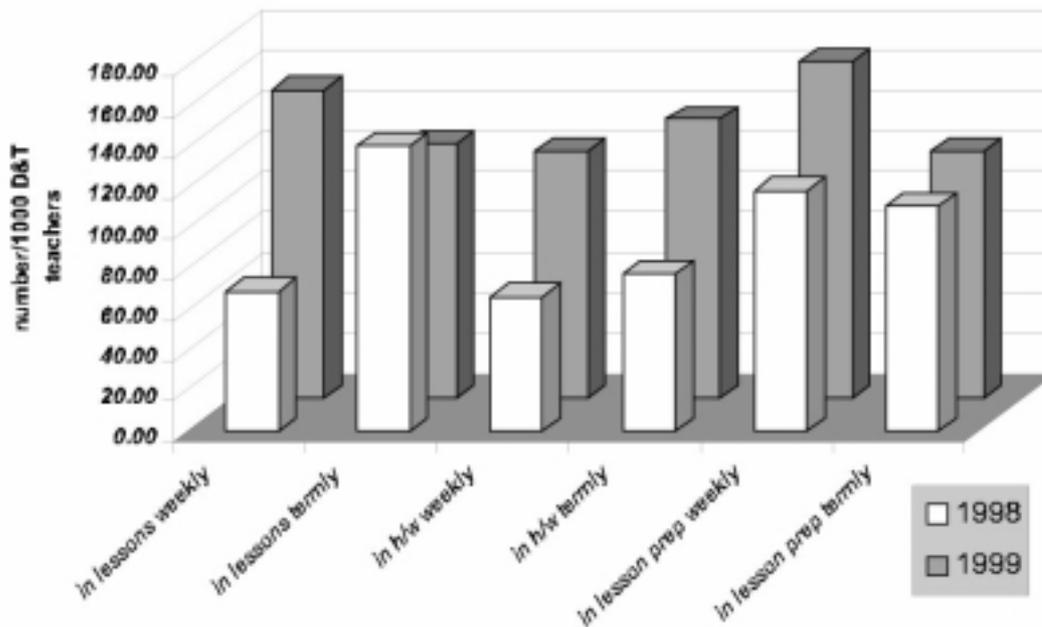


Figure 14 Use of the Internet by D&T teachers

### Conclusions

There has been a very rapid development of Internet access in British secondary schools over the period studied. This is largely the result of government policy and it could be argued that it is in advance of demonstrated need, staff competence and research evidence of its value. Selwyn (1998, 1999 a, b, c) has extensively questioned the wisdom and motivation underlying this move, but it remains a fact that the equipment is largely in place, the investment has been made, whether wisely or not and it is now the province of the educators to try to extract maximum benefit from the changes that NGfL funding has brought about.

A significant factor affecting Internet use in D&T departments will be the provision of effective on-line resources to support teaching and learning. Some resources exist already and the providers of these will need to continue to refine and maintain their materials even at a time when it appears that little use is being made of them; it is likely to be at least another 5 years before demand for such resources becomes anything like universal. In the meantime, it will be the availability and further development of these materials that will give D&T departments the incentive to devote limited energy and resources to expanding their access to and use of the Internet.

Little is still known about how to support learning effectively using this new medium; this period of limited access should be viewed as an opportunity to plug this gap in our knowledge so that when the demand does materialize, appropriate materials are ready to meet it. In particular approaches to web design to support D&T education need to be found that are appropriate to the medium (rather than aping paper or CD-ROM based materials), are in tune with the desire to develop capability in designing and making (rather than having other aims that are, perhaps, easier to achieve with ICT) and are driven by good pedagogy (rather than simply the desire to reduce costs).

Despite investment in infrastructure and equipment, we find that current use of the Internet is at a very low level, but it must be remembered that this paper presents a snapshot of schools in a time of transition and the next few rounds of data collection can be expected to show continuing rapid change. Most significantly, whilst hardware has been put in place, staff training is only just beginning under the NOF scheme (NOF, 2000; DfEE, 1998b) and we believe that it is the quality of the experience provided by this training that will make or break the whole programme. If staff are genuinely motivated and classroom culture is significantly changed, then the

rewards will be reaped.

Our data suggest one possible cloud on the horizon: the problem of bandwidth. Most schools have either a 64kbps or a 128kbps connection. This is quite able to sustain the current low levels of usage, but if demand for access increases significantly in the next few years, this type of connection will rapidly be found inadequate to support substantial whole school use of the Internet. Hartley (2000) convincingly argues that there has been 'computer power to waste', that is to use freely without significant rationing by cost, for some years and that present technology has delivered 'bandwidth to waste', but traditional pricing and profit structures are preventing its realisation. When all other obstacles to Internet use have vanished, it may well be that the provision of adequate bandwidth at affordable cost is the final problem. Our work suggests that to sustain the projected levels of use in a medium to large secondary school will require a minimum connection in the order of 2Mbps and a comparable bandwidth for distribution around the school. Technologies just over the horizon may well exacerbate this problem; even if schools increase bandwidth, rather than providing faster access for more pupils at present levels of data transfer, the demand for high bandwidth graphics, audio and video will still mean that schools are unable to afford the bandwidth that they need to give reasonably fast access to most pupils who require it.

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